reduced accordingly because we could focus on a smaller spot. By doing so we could reduce the energy per pulse requirement from about 80 mJ/pulse to as low as about 10 mJ/pulse.

The cost of laser diodes for pumping solid state lasers is primarily dominated by the peak power requirements and this determines the number of diode bars. By operating the bars at a relatively high duty factor of 20 percent and generating a large number of pulses per second, we can minimize the initial cost of the diode pumping system. For example, a 1 kW system may require 3 kW average power from the pump diodes, a 20 percent duty factor diode array system would require 15 kW peak power. Using 50 Watt peak bars at $700 per bar, the system would cost $210,000. In comparison, a 1 percent duty factor system would require 300 kW peak power. The cost would be $4,000,000. Increasing the duty factor above 20 percent, all the way to CW is feasible, but, balancing all factors (including system lifetime and complexity), we prefer a duty factor of about 20 percent. Persons skilled in the art will recognize that a flash lamp pumping system could replace the diode pumping system.

The first preferred seed beam pulse train frequency could be in the range of 10 MHz to 200 MHz or greater. With some compromise in the average power the number of pulses per second could be reduced down to about 1,000 Hz.

The amplifier can be of slab or rod design. The solid state material can be of a host material other than Nd:YAG. For example, Nd:YLF, Cr:LiSAF, Ti:S, etc. could be used. Amplification needed to boost the seed beam to the mJ/pulse level can be satisfied by either high gain or multiple passes. Up to eight passes can be done with passive components and much higher number of passes can be done in a regenerative amplifier. The steering mirror in the amplifier can be any reflecting element that would be appropriate to generate the cluster of spot sizes desired, such as the 20 μm spots.

With respect to the first preferred embodiment, other devices could be substituted for the electro-optic modulator for pulse spacing, such as cavity dumping or even an optical rotary interrupter. The pulse spacing devices would in most applications remove a very large percentage of the pulses in the first preferred seed beam such as more than 99 percent as in the preferred embodiment described; however, We could imagine applications where as the percentage remove might be as low as 80 percent. Accordingly the reader is requested to determine the scope of the invention by the appended claims and their legal equivalents, and not by the given examples.

We claim:

1. A high average power, high brightness solid state pulse laser system comprising:

a) a seed laser subsystem means for producing a seed pulse laser beam with a pulse frequency in excess of 1,000 pulses per second each pulse having a duration of less than 1 ns,

b) a laser amplifier means for amplifying said seed pulse laser beam to produce an amplified pulse laser beam comprising high frequency pulses, said amplified pulse laser beam having an average power in excess of 10 Watts,

c) a focusing means for focusing said amplified pulse laser beam to a small spot size on a target, said spot size being small enough to produce a brightness level in excess of 10^{11} W/cm^2.

2. A pulse laser system as in claim **1** wherein said seed laser subsystem means comprises a pulse spacing selector means for removing more than 80 percent of the pulses in a laser beam to produce said first pulse laser beam.

3. A pulse laser system as in claim **2** wherein said beam steering means comprises a PZT device attached to a mirror.

4. A pulse laser system as in claim **2** wherein laser means comprises a mode locked laser oscillator comprising a mode locking means for producing a mode locked laser beam.

5. A pulse laser system as in claim **4** wherein said mode locking means is an acousto-optic mode locker.

6. A pulse laser system as in claim **2** where in said pulse selector means comprises an electro-optic modulator.

7. A pulse laser system as in claim **1** and further comprising a beam steering means for rapidly steering said amplified pulse laser beam relative to said target so as to simulate a spot size larger than said small spot.

8. A pulse laser system as in claim **1** wherein said beam steering means comprises a means for moving said target relative to said amplified pulse laser beam.

9. A pulse laser system as in claim **1** wherein said laser amplifier means comprises a multiple-pass Nd:YAG laser amplifier pumped by a pumping means.

10. A pulse laser device as in claim **9** wherein said pumping means comprises a plurality of laser diode arrays.

11. A pulse laser system as in claim **9** wherein said pumping means comprises a flash lamp.

12. A pulse laser system as in claim **1** wherein said laser amplifier means comprises a Nd:YAG polished rod pumped by a plurality of laser diode arrays.

13. A pulse laser system as in claim **12** wherein said laser diode arrays are programmed to operate CW.

14. A pulse laser system as in claim **12** wherein said plurality of laser diode arrays are programmed to operate at a duty factor of less than 100 percent.

15. A pulse laser system as in claim **14** wherein said duty factor is about 20 percent.

16. A pulse laser system as in claim **15** wherein said amplified pulse laser beam comprises a series of periodically spaced high frequency pulses.

17. A pulse laser system as in claim **1**, and further comprising a target for the production of X-rays upon illumination at said small spots.

18. A pulse laser system as in claim **17** wherein said target is comprised of a metal.

19. A pulse laser system as in claim **18** wherein said metals is chosen from a group consisting of copper and iron.

20. A pulse laser system as in claim **1** wherein said seed laser subsystem defines a resonator and comprises a mode locked laser comprising a Q switch.

21. A pulse laser system as in claim **20** wherein said Q switch is a high gain Q switch having a gain in excess of 10 per pass and said resonator is a short resonator shorter than 4 inches.

22. A pulse laser system as in claim **20** wherein said seed laser subsystem further comprises a cavity dumper.

23. A pulse laser system as in claim **1** wherein said seed laser subsystem comprises a laser crystal having a reflective side, a $\lambda/2$ Pockels cell and a polarizer beam splitter and said system defined by a length L being the distance between said reflective side and said pockels cell.

24. A pulse laser system as in claim **23** wherein said length L is no greater than 4 cm.

25. A pulse laser system as in claim **24** wherein said length L is no greater than 2 cm.

26. A pulse laser system as in claim **1** wherein said laser amplifier defines an operating wavelength and said seed laser subsystem comprises a laser diode producing a pulsed laser beam having a wavelength matched to the operating wavelength of said laser amplifier.

27. A pulse laser system as in claim **1** and further comprising a frequency increasing means placed in the